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(21) Application No. 32674/73 (22) Filed 9 July 1973

(44) Complete Specification published 28 April 1976

(51) INT. CL.² B60C 11/08 13/00

(52) Index at acceptance

B7C 3B12 3D3

(19)



(54) IMPROVEMENTS IN OR RELATING TO TYRES

(71) We, CATERPILLAR TRACTOR CO., a Corporation organised and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois, United States of America, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to tyres.

Tyres employed on earthworking vehicles, such as loaders, may be subjected to severe conditions. For example, when such tyres are used on vehicles operating in a rock quarry there is a tendency for sharp rocks to puncture or otherwise severely damage the tyre's sidewalls.

The present invention provides a tyre comprising an annular tread having a plurality of circumferentially spaced tread bars formed thereon said tread bars extending substantially axially of said tyre to define a slot between each pair of circumferentially adjacent tread bars, an annular sidewall extending inwardly towards the tyre axis on each side of said tread, each of said slots being tapered to diverge axially outwardly towards an adjacent sidewall of the tyre, and a continuous circumferential deflector ring formed at the juncture of each sidewall with said tread to project axially outwardly beyond the sidewall, to deflect matter at the footprint of the tyre tread away from the sidewall and thereby protect the sidewall when said tyre is in both its unloaded and loaded conditions of operation.

One embodiment of a tyre in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings in which:—

FIG. 1 is an isometric view of the tyre;
FIG. 2 is a top plan view of a portion of

the tyre's tread;

FIG. 3 is a sectional view of the tyre, taken on the line III-III in FIG. 1, showing the tyre in an unloaded condition of operation; and

FIG. 4 is a view similar to FIG. 3, but showing the tyre in a loaded condition of operation.

FIG. 1 illustrates a wheel rim 10 having a tyre 11 of this invention suitably mounted thereon for rotation about a central axis *A* thereof. The tyre comprises an annular tread 12 having a plurality of circumferentially spaced tread bars 13 formed thereon. The tread bars extend with an uninterrupted surface substantially axially of the tyre to define a slot 14 between each pair of circumferentially adjacent tread bars.

An annular sidewall 15 extends inwardly from the tread towards axis *A* on each side of the tyre and terminates at a suitable bead (not shown) mounted on rim 10. A circumferential deflector ring 16 is formed at the juncture of each sidewall with the tread to project axially outwardly beyond the sidewall. As shown in the FIGS. 3 and 4 relating to unloaded and loaded conditions of tyre operation, respectively, such deflector rings fully protect the sidewalls by deflecting matter ejected from the footprint of the tyre tread away from the sidewalls and their axially outermost extremities are continuously spaced from the sidewalls at a distance *B*.

Referring to FIG. 2, a first series of tread bars 13, positioned adjacent to one sidewall, are staggered circumferentially with respect to a second series of tread bars positioned adjacent to the opposite sidewall. Each tread bar of one series is thus axially aligned with a respective slot 14 defined between a pair of circumferentially adjacent tread bars of the other series. A centrally disposed, annular

circumferential rib 17 is formed on the tread between the two series of tread bars.

The axial width *C* of the rib 17 preferably approximates one third of the tyre's width at the deflector rings 16. A circumferentially continuous and uninterrupted ring of solid rubber is thus provided between the ground and the tyre carcass during all phases of tyre operation. For example, should any of the tread bars be torn off, a continuous ring of rubber will remain on the tyre to permit the vehicle to continue to operate safely.

The circumferential extent *D* of each tread bar is preferably approximately one and one-half times the circumferential extent *E* of a respective slot 14. The slots are tapered to diverge axially outwardly away from the rib 17. Such configuration aids in the tyre's self-cleaning function whereby mud and the like is automatically ejected from the slots during tyre rotation.

Referring to FIGS. 3 and 4, each slot is defined by a preferably slightly arcuate bottom surface 18 extending between the associated pair of circumferentially spaced tread bars 13. Each tread bar comprises a radially outer uninterrupted surface 19, preferably diverging from surface 18 axially outwardly to further aid in the self-cleaning function, and an axially outer surface 20. Surfaces 18 and 20 at least approximately tangentially intersect an apex 21 of rounded section deflector ring 16.

As shown in the unloaded condition in FIG. 3, at least a substantial portion of surface 18 defines an acute angle *X* with surface 20, preferably approximating thirty-five degrees, which remains at least approximately constant when the tyre tread is compressed to its FIG. 4 loaded condition. An acute angle *Y* defined between top radially outer surface 19 and an imaginary plane *G* representing a horizontal ground surface changes from approximately twenty-five degrees in the unloaded condition of FIG. 3 to zero degrees in the loaded condition of FIG. 4. During such transition, an acute angle *Z* defined between axially outer surface 20 and the ground surface changes from approximately seventy degrees to approximately fifty-five degrees. The tyre may be constructed to vary one or more of the angles illustrated in FIG. 3 plus or minus ten degrees, for example, so long as the herein described functional desiderata are achieved.

During tyre operation and upon flexing thereof between its FIG. 3 and FIG. 4 positions, foreign matter at the footprint of the tyre will be deflected axially away from the tyre's sidewalls to prevent damage thereto. Such deflecting function is accomplished due to the inherent cooperation afforded between the above-described

deflector rings and tread bars. The tapered configuration of slots 14 also tends to expel foreign materials therefrom, rather than enveloping same. In addition, the integrated construction of the deflector ring, tread bars and slots facilitates the employment of a thick tyre cross section adjacent to the deflector rings as shown in FIGS. 3 and 4 to greatly increase the structural integrity thereof.

WHAT WE CLAIM IS:—

1. A tyre comprising an annular tread having a plurality of circumferentially spaced tread bars formed thereon, said tread bars extending substantially axially of said tyre to define a slot between each pair of circumferentially adjacent tread bars, an annular sidewall extending inwardly towards the tyre axis on each side of said tread, each of said slots being tapered to diverge axially outwardly towards an adjacent sidewall of the tyre, and a continuous circumferential deflector ring formed at the juncture of each sidewall with said tread to project axially outwardly beyond the sidewall, to deflect matter at the footprint of the tyre tread away from the sidewall and thereby protect the sidewall when said tyre is in both its unloaded and loaded conditions of operation.

2. A tyre as claimed in claim 1, wherein a first and a second series of said circumferentially spaced tread bars are each formed on said tread adjacent to a respective one of said sidewalls and further comprising an annular circumferential rib formed on said tread and positioned axially between said first and second series of tread bars.

3. A tyre as claimed in claim 2, wherein the tread bars of said first series are staggered circumferentially relative to the tread bars of said second series.

4. A tyre as claimed in claim 3, wherein each tread bar of one of said first and second series is axially aligned with a respective slot defined between a pair of circumferentially adjacent tread bars of the other series.

5. A tyre as claimed in claim 2, 3 or 4, wherein the axial width of said annular rib approximates one-third of the axial width of said tyre at said deflector rings.

6. A tyre as claimed in any preceding claim, wherein the circumferential extent of each of said tread bars approximates one and one-half times the circumferential extent of each of said slots, said extents being measured at the axially outward end of the bars and slots.

7. A tyre as claimed in any preceding claim, wherein said deflector rings are so shaped in cross-section as to have an apex, and in each slot a surface defining the

bottom of the slot intersects the apex of a deflector ring.

8. A tyre as claimed in claim 7, wherein each of said tread bars comprises
5 a radially outer surface positioned radially outwardly from the bottom surface of an adjacent slot and an axially outer surface intersecting said radially outer surface and a deflector ring.
- 10 9. A tyre as claimed in claim 8, wherein said deflector rings are rounded in cross-section, and said axially outer surface and said bottom surface both at least approximately tangentially intersect the apex
15 of a deflector ring.
10. A tyre as claimed in claim 8 or 9, wherein at least a substantial portion of said bottom surface forms an acute angle with said axially outer surface which remains at least approximately constant upon
20 deflection of said tyre from an unloaded condition in which, when the rotational axis of the tyre is horizontal, said radially outer surface is inclined to an imaginary
25 plane representing a horizontal ground surface, to a condition in which the tyre is loaded such that, with said axis horizontal, said radially outer surface makes an angle of zero degrees with said plane.
- 30 11. A tyre as claimed in claim 10, wherein said acute angle approximates thirty-five degrees.

12. A tyre as claimed in claim 8, 9, 10 or 11, wherein, when the rotational axis of the tyre is horizontal, an acute angle de- 35 fined between an imaginary plane, representing a horizontal ground surface, and said radially outer surface approximates twenty-five degrees in the unloaded condition of said tyre and becomes zero de- 40 grees on application of a sufficient load to the tyre.

13. A tyre as claimed in any one of claims 8 to 12, wherein, when the rotational axis of the tyre is horizontal, an acute angle defined between an imaginary 45 plane representing a horizontal ground surface and said axially outer surface approximates seventy degrees in the unloaded condition of said tyre and fifty-five degrees 50 when the tyre is loaded such that said radially outer surface makes an angle of zero degrees with said imaginary plane.

14. A tyre substantially as hereinbefore described with reference to and as shown in 55 the accompanying drawings.

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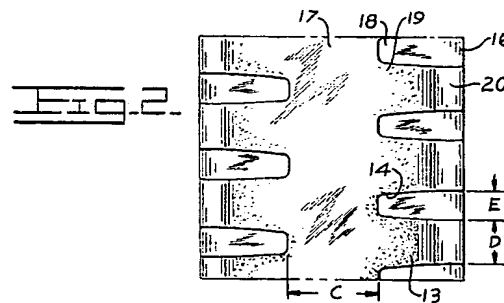
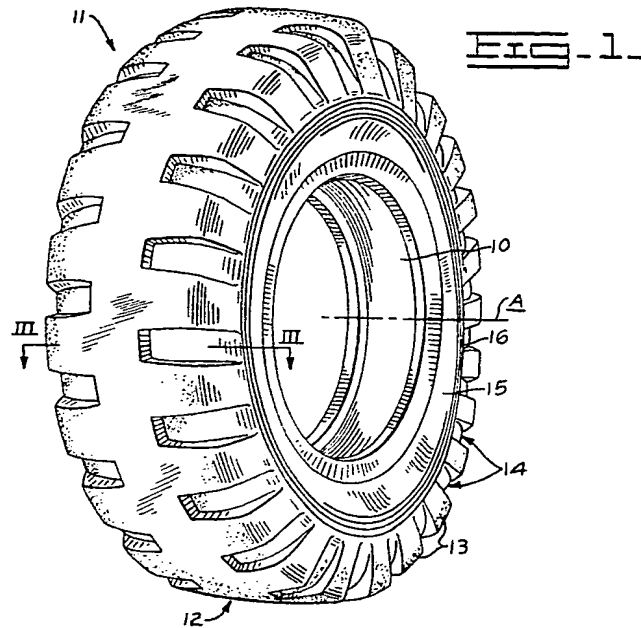


Fig. 3.
UNLOADED CONDITION

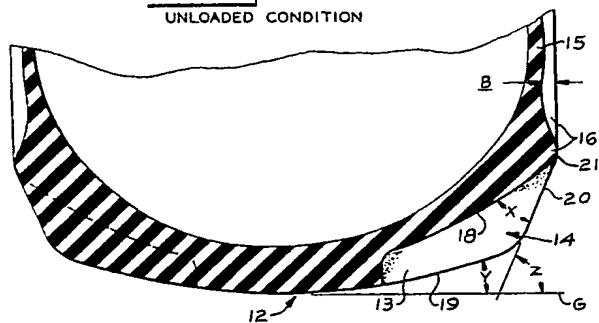
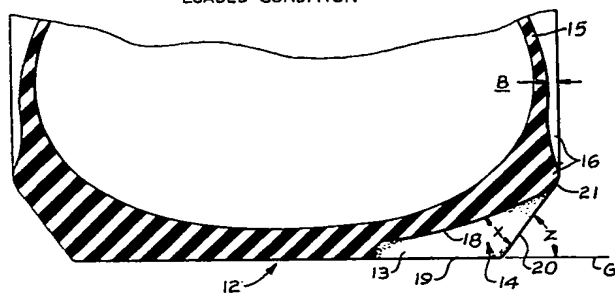


Fig. 4.
LOADED CONDITION



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